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PROJECT STUDY REPORT

HIGHWAY 101 GREENBRAE/ TWIN CITIES CORRIDOR IMPROVEMENT PROJECT

To

Request:

- Conceptual Approval
- Concurrence to Proceed with the PA & ED Phase

On Route: 04-Mrn-101

Between: 0.2 miles south of the Tamalpais Drive Overcrossing

And: 0.3 miles north of the Corte Madera Creek Overcrossing

APPROVAL RECOMMENDED: _____

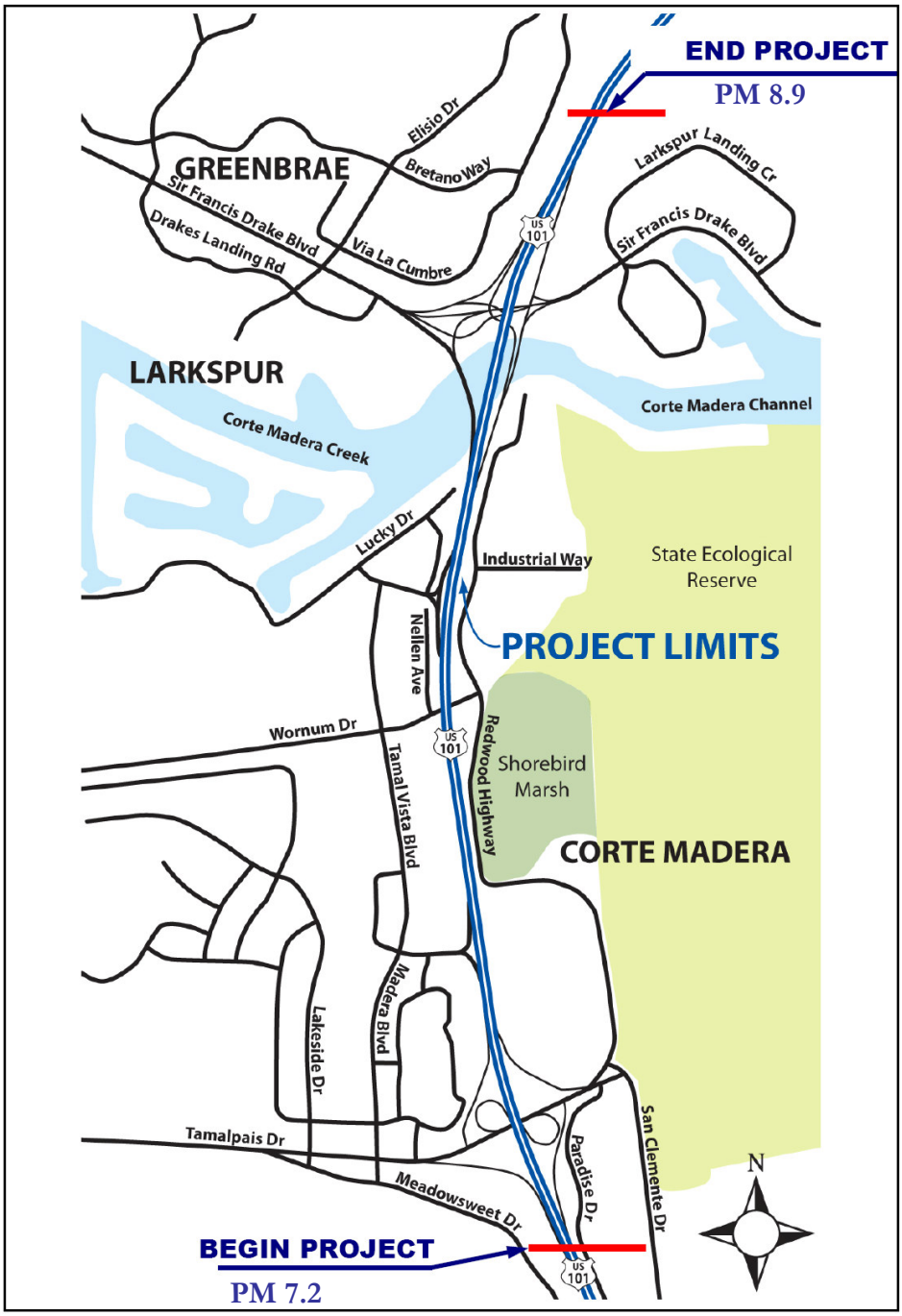
BETCY JOSEPH
PROJECT MANAGER

APPROVED:

_____ _____

BIJAN SARTIPI
DISTRICT DIRECTOR DATE

Vicinity Map



On Route: 04-Mrn-101

Between: 0.2 miles south of the Tamalpais Drive Overcrossing

And: 0.3 miles north of the Corte Madera Creek Overcrossing

This Project Study Report has been prepared under the direction of the following Registered Engineer. The Registered Civil Engineer attests to the technical information contained herein and the engineering data upon which recommendations, conclusions, and decisions are based.

_____ _____

REGISTERED CIVIL ENGINEER *DATE*

Sean Mayer, PE
Jacobs
300 Frank H Ogawa Plaza, Suite 10
Oakland, CA 94612

Reviewed By:

_____ _____

PATRICK K. PANG, OFFICE CHIEF *DATE*
OFFICE OF ADVANCE PLANNING

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PROJECT STUDY REPORT

HIGHWAY 101 GREENBRAE/ TWIN CITIES

CORRIDOR IMPROVEMENT PROJECT

1. INTRODUCTION

This project proposes to provide freeway and interchange operational improvements along the existing US 101 freeway corridor between the Tamalpais Drive interchange in the Town of Corte Madera and the Sir Francis Drake Boulevard Interchange in the City of Larkspur, which is also known as the Greenbrae Corridor in Marin County. Due to existing traffic congestion and projected traffic growth in this freeway corridor over the next 30 years, the Transportation Authority of Marin (TAM) is sponsoring this Project Study Report (PSR) to identify needed improvements within this major freeway Corridor.

Using a context sensitive design approach, over twenty improvement concepts have been developed working in cooperation with project stakeholders. Each of these concepts were evaluated and considered by TAM during the past three years. These improvement concepts were grouped as southbound US 101 improvements and northbound US 101 improvements to facilitate engineering analysis and review by the various project stakeholders. Based on input from Caltrans; Marin County; the Town of Corte Madera, the City of Larkspur, and the City of San Rafael; extensive stakeholder interviews; three public workshops held on October 24, 2006, March 27, 2007, and March 8, 2008; Technical Advisory Team and city council meetings; and TAM Board Meetings, the improvement concepts were further refined and screened down to one (1) southbound design option, and one (1) northbound design option.

The Build Alternative as defined for this project and presented in this PSR combines what was previously referred to as Southbound Option C and Northbound Option E

Previous design options

Southbound Option C - Braided Ramps at Sir Francis Drake Boulevard on-ramp and Wornum Drive off-ramp

Northbound Option E - Braided Ramps at northbound Wornum Drive on-ramp and Sir Francis Drake Boulevard/Industrial Way off-ramp

Project cost for the Build Alternative is $143.7 million. This cost includes engineering support and right-of-way support. Cost for right-of-way acquisition is estimated at $9.6 million.

This project is sponsored by TAM, in cooperation with Caltrans, and will be funded by the Regional Measure 2 Program administered by the Metropolitan Transportation Commission (MTC).

Working with Caltrans, it has been determined that a Complex Environmental Assessment/Initial Study (EA/IS) is the appropriate environmental document for the proposed project. Caltrans will be the lead agency for both the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA).

Project Limits: 04-Mrn-101, PM 7.2-8.9

Number of Alternatives: Two Alternatives:

1. **No-Build**

2. **Build Alternative**
   Includes improvement on southbound and northbound US 101 and multi-modal improvements

Alternative Recommended for Programming: Based on the input received from Caltrans, various project stakeholders, and technical engineering studies completed to date, it is recommended that the No-Build and Build Alternatives be carried forward into the PA & ED phase of the project.

Programmed or Proposed Capital Project Costs Capital Cost (in millions) for the build alternative in 2010 dollars is $102.4 million. This includes construction costs and right of way costs.

Programmed or Proposed Capital Right of Way Costs: Total Right of Way Cost is $9.6 M

Funding Source: This project is sponsored by TAM in cooperation with Caltrans, and will be funded by Regional Measure 2 Program administered by MTC.

Type of Facility: Freeway

Number of Structures: Seven (7) Structures:

- Corte Madera Creek Bridge Southbound on-ramp
- Wornum Drive off-ramp
- Box Culvert Extension at Mainline Station 195+65
- Sir Francis Drake off-ramp
- Corte Madera Creek Bridge Northbound off-ramp
- Wornum Drive Tie Back Wall
- Wornum Drive Soil Nail Wall

Anticipated Environmental Determination/Document:	Complex EA/IS
Legal Description:	PM 7.2 to PM 8.9 On Route US 101 from 0.2 miles south of the Tamalpais Drive Interchange to 0.3 miles north of the Sir Francis Drake Boulevard Interchange (also known as the Greenbrae Interchange)
Project Category:	Category 3: Project would modify existing interchanges, and would realign, add, and/or remove existing on and off-ramps. Additional Right-of-Way would be required.

2. BACKGROUND

US 101 is a critical south-north freeway link that serves the entire Bay Area. Within the study area, this corridor provides a vital regional transportation facility for people commuting to work from Sonoma and Marin Counties to Alameda and San Francisco Counties. In addition, the Greenbrae Corridor provides an essential and key local connection for traffic traveling in and between the Town of Corte Madera, the City of Larkspur, and the City of San Rafael. The Greenbrae Corridor also serves as one of the primary routes for local traffic crossing the Corte Madera Creek to access school, shopping, businesses, and recreational facilities in the Town of Corte Madera and the City of Larkspur.

The Greenbrae Corridor provides access to major transit centers such as the Golden Gate Larkspur Ferry Terminal located on the east side of US 101, between Sir Francis Drake Boulevard and the Corte Madera Creek. This ferry terminal provides essential services for people traveling from the Marin County area to San Francisco. In addition, the Sonoma Marin Area Rail Transit (SMART) District is planning a train station near the Larkspur Ferry Terminal, making it a multi modal access point for transit users. The US 101 freeway and the on and off-ramps also serve regional bus service provided by Golden Gate Transit District and Marin County Transit District.

The US 101/Sir Francis Drake Boulevard interchange is critical to the health of the region as it plays a key role for both regional and local traffic flow and operations. This interchange serves regional traffic between US 101 and the Richmond/San Rafael Bridge; and it is also the gateway to the Larkspur Ferry Terminal, City of Larkspur, and the communities of Greenbrae and Kentfield. At the local level, the interchange along with US 101 provides the primary road crossing over the Corte Madera Creek. Local traffic utilizes the US 101/Sir Francis Drake Boulevard interchange to cross Corte Madera Creek as it provides the only southbound connection between Sir Francis Drake Boulevard and Tamal Vista Boulevard, Lucky Drive, Fifer Avenue, and Redwood Highway. In the northbound direction, traffic from the area south of Corte Madera Creek uses the northbound Industrial Way on-ramp and the US 101/Sir Francis Drake Boulevard interchange to access Sir Francis Drake Boulevard and the on-ramp to northbound US 101.

As increased regional and local traffic puts more pressure on the US 101 corridor and the US 101/Sir Francis Drake Boulevard Interchange, the need to balance local and regional traffic and to make improvements on both the freeway and local transportation systems are critical to maintaining safe traffic operations within the Greenbrae Corridor.

2.1 Description of Existing Facilities

US 101 is a multi-lane freeway that provides an interregional connection for cities within the San Francisco Bay Area. Originating south at its junction with I-5 in Los Angeles, US 101 extends through eleven major counties in California before continuing north to the California-Oregon border. Within the project limits, the roadways that connect with US 101 include Sir Francis Drake Boulevard, Lucky Drive/Fifer Avenue (west of US 101); Industrial Way (east of US 101, Madera Boulevard (west of US 101), and Tamalpais Drive. Within the project limits, the majority of the freeway segment consists of four lanes in each direction comprised of three mixed flow lanes and one high occupancy vehicle (HOV) lane.

The **Sir Francis Drake Boulevard Interchange** serves as a major interchange on US 101 in the City of Larkspur. It is a modified Type L-1, diamond interchange configuration, with ramps from northbound and southbound US 101 to Sir Francis Drake Boulevard, and from Sir Francis Drake to northbound and southbound US 101.

Lucky Drive/Fifer Avenue on and off-ramps provide access to and from southbound US 101 via Type L-6 Configuration hook ramps.

Industrial Way on and off-ramps provide access to and from northbound US 101 via Type L-6 Configuration hook ramps.

Wornum Drive is a two-lane city arterial that passes under US 101 and provides a connection between Tamal Vista Boulevard (west of US 101) and Redwood Highway (east of US 101). Currently, there is no freeway access to and from Wornum Drive.

Madera Boulevard on and off-ramps provide access to and from southbound US 101 via Type L-6 Configuration hook ramps. Madera Boulevard is a northeast-southwest roadway between the on and off-ramps to southbound US 101 and its intersection with Tamalpais Drive.

Tamalpais Drive interchange serves as a major interchange in the Town of Corte Madera. It is a Type L-9 Configuration, partial cloverleaf design, with loop on-ramps to northbound and southbound US 101.

Redwood Highway is the only north-south arterial on the east side of US 101 and runs parallel to US 101. It is a two-lane roadway connecting Tamalpais Drive to the south and the Greenbrae Boardwalk along Corte Madera Creek to the north.

Tamal Vista Boulevard is a major north-south local street on the west side of US 101. It connects Fifer Avenue to the north and Madera Boulevard to the south. Thereafter, Madera

Boulevard continues south to Tamalpais Drive. It is a two-lane roadway with left turn lanes at key intersections.

2.2 Project Sponsor and Funding

TAM is the sponsoring agency for this project. TAM is responsible for all phases of project development for this project.

The project is funded by the Regional Measure 2 Program administered by MTC.

Stakeholder agencies include Caltrans, Marin County, City of San Rafael, City of Larkspur, the Town of Corte Madera, Golden Gate Transit, and Marin County Transit District.

All three local jurisdictions in the project area have been involved with the project development process and the development of the design concepts. The local jurisdictions support making improvements to the Greenbrae Corridor. Representatives of the local jurisdictions also serve on the TAM Board, Greenbrae Corridor Ad-hoc Committee, and the Technical Advisory Committee.

3. PURPOSE AND NEED

3.1 Need

- During the peak travel periods the existing roadway capacity is not adequate to meet current and future traffic demand, leading to congestion on both US 101 and Sir Francis Drake Boulevard. The most substantial existing problems are:
    - The northbound off-ramp from US 101 to Sir Francis Drake Boulevard cannot handle high traffic volumes. This causes traffic to back up onto US 101.
    - The southbound US 101 on-ramp from Sir Francis Drake Boulevard cannot handle high traffic volumes and has a lane drop that does not meet current Caltrans standards. This causes traffic to backup onto Sir Francis Drake Boulevard.
- Level of Service E or F is typically considered unacceptable by Caltrans and indicates a need for improvement. Currently, during peak travel times on US 101, all northbound segments within the project corridor are operating at Level of Service E or F, and one southbound segment is operating at Level of Service E. Existing congestion is projected to worsen as population, employment and traffic in the region grows. Congestion is likely to spread to affect more hours of the day and spillover onto adjacent streets.

- There are two locations on US 101 where closely spaced on- and off-ramps exacerbate congestion. In order to exit or enter the highway in these locations, drivers must weave through traffic at the following locations:

    - **Northbound US 101 between the on-ramp at Industrial Way and the off-ramp at Sir Francis Drake Boulevard**. Traffic entering mainline US 101 at the Industrial Way on-ramp is prohibited by lane striping only. Motorists can, and often do, make the unsafe movement across two lanes to join highway traffic, interfering with drivers exiting the highway at Sir Francis Drake Boulevard. By 2035, during the PM peak period, traffic entering and exiting the highway at this location is anticipated to increase by 55%, and 26%, respectively.

    - **Southbound US 101 between the on-ramp from Sir Francis Drake Boulevard and the off-ramp at Fifer Avenue**. In addition to regional traffic accessing the highway, this set of ramps is used by local traffic to access points south of Corte Madera Creek. Without this access, local traffic would require an additional three miles of out of direction travel to reach points south of Corte Madera Creek. By 2035, during the AM peak period, traffic entering and exiting the highway at this location is anticipated to increase by 19%, and 122%, respectively.

- The collision rate for northbound US 101 along the Greenbrae Corridor exceeds the statewide average for similar roadways and traffic conditions. Approximately 68% of the accidents are rear ends, which are common in stop and go traffic conditions. The second most frequent accident type (19%) is side-swipes, which can occur during lane changes as traffic enters and exits the highway. Nearly 75% of collisions occurred during the PM peak travel period.

- Access to multi-modal facilities, such as the Larkspur Ferry Terminal, regional and local bus stops, and multi-use paths, is constrained by the limited connectivity across Corte Madera Creek, as well as to the east and west sides of US 101. These multi-use paths are heavily used by pedestrians and bicyclists to reach residential, commercial, and community destinations, as well as, local and regional transit facilities along the corridor. In addition, existing bicycle and pedestrian projects, such at the Central Marin Ferry Connection Multi-Use Pathway and the Cal Park Hill Tunnel, would not have their full potential realized without improved multi-modal connectivity within the study area.

- The poor linkages between multi-modal facilities along the corridor limit connectivity between local and regional transit options, reduce the overall attractiveness of transit, and also limit user groups. This situation is exacerbated by the existing pedestrian overcrossing at Nellen Avenue, which is a non- Americans with Disabilities Act compliant facility.

3.2 Purpose

The purpose of the proposed project is described below.

- To reduce congestion on the US 101 mainline between Sir Francis Drake Boulevard and Tamalpais Drive.
- To enhance regional and local connectivity for vehicles from I-580 traveling westbound on East Sir Francis Drake Boulevard to southbound US 101 and local roads south of Corte Madera Creek.
- To improve local and regional access by separating local and US 101 mainline traffic.
- To improve access to local and regional multi-modal facilities for all modes.
- To improve the operational safety within the corridor.

4. DEFICIENCIES

4.1 Existing Design Deficiencies

In the southbound direction of US 101, the weaving distance between the Sir Francis Drake Boulevard on-ramp and Lucky Drive off-ramp is approximately 900 feet. The weaving distance between the Lucky Drive/Fifer Avenue on-ramp and the Madera Boulevard off-ramp is 2,200 feet. The weaving distance between the Madera Boulevard on-ramp and the Tamalpais Drive off-ramp is 400 feet. In addition, the existing southbound US 101 hook on and off-ramps at Lucky Drive and at Madera Boulevard do not provide standard acceleration and deceleration lengths.

In the northbound direction of US 101, the weaving distance between the Industrial Way on-ramp and the Sir Francis Drake Boulevard off-ramp is 600 feet. The northbound US 101 off-ramp at Industrial Way has a nonstandard off-ramp deceleration length. In addition, the sidewalk along the northbound US 101 off-ramp to Sir Francis Drake, which provides pedestrian access across Corte Madera Creek, does not meet current ADA standards.

Because of the short, nonstandard weaving distances, project stakeholders have raised concerns about safety and freeway operations at the locations noted above.

4.2 Existing Traffic Operations Deficiencies

Currently, northbound US 101 operates at level-of-service (LOS) F during the PM peak hour of travel from the Tamalpais Drive interchange to the US 101/I-580 interchange, which is north of Sir Francis Drake Boulevard interchange. Congestion and queuing exists throughout this entire freeway segment. Existing LOS for segments in the project area are summarized below in Table 4.1. The traffic operations analysis is contained in Attachment C, Traffic Forecast Data, and Attachment D, Traffic Operations Analysis.

Table 4.1 Existing US 101 Freeway Segment Levels of Service

Freeway Segment	AM Peak Hour		PM Peak Hour	
	Density[1]	LOS	Density[1]	LOS
Northbound US-101				
Between Edge of study area and Tamalpais	18	B	64	E
Between Tamalpais and Industrial	24	C	74	**F**
Between Industrial and Sir Francis Drake [2]	n/a	n/a	n/a	n/a
Between Sir Francis Drake and I-580 Off-ramp	19	C	106	**F**
Southbound US-101				
Between Anderson Drive Off-ramp and Sir Francis Drake	37	E	19	C
Between Sir Francis Drake and Fifer (weave)	29	D	20	C
Between Fifer and Madera (weave)	35	D	22	C
Between Madera and Tamalpais (weave)	29	D	19	B
Between Tamalpais and Edge of study area	23	C	17	B

Notes:

1. Density is expressed in vehicles per mile per lane and is based on the average of thirteen model runs.
2. No weaving is permitted between the Industrial Drive on-ramp and the Sir Francis Drake off-ramp. Industrial Drive traffic must travel along the Sir Francis Drake off-ramp and proceed through the ramp intersection before entering northbound US 101.

Source: Fehr & Peers, July 2009

The southbound US 101 on-ramp from Sir Francis Drake Boulevard is a two-lane ramp that narrows to a single lane prior to merging onto the freeway mainline. This single-lane on-ramp and the downstream freeway section do not provide adequate capacity to meet the existing traffic demand resulting in recurrent traffic queuing on the on-ramp during peak hours. With the future traffic demand projected in the corridor, the existing traffic condition would continue to deteriorate and queuing on the southbound US 101 on-ramp will adversely impact the operations on Sir Francis Drake Boulevard, which connects US 101 to I-580 to the east. Sir Francis Drake

Boulevard also serve as a critical west/east arterial street that provides access to Kentfield, Ross, San Anselmo, Fairfax, and other cities west of US 101.

There are also operational deficiencies at the weaving section between the northbound US 101 on-ramp from Industrial Way and the northbound off-ramp to East Sir Francis Drake Boulevard. Traffic entering US 101 from the northbound Industrial Way on-ramp must weave across two lanes of traffic, in a 600 foot long weave section, to access northbound US 101. This creates a conflict with the northbound US 101 traffic exiting the freeway at East Sir Francis Drake Boulevard. In many instances, drivers wishing to access northbound US 101 from the Industrial Way on-ramp are forced to use the East Sir Francis Drake Boulevard off-ramp, traverse the signalized intersection at East Sir Francis Drake Boulevard, and access northbound US 101 using the northbound East Sir Francis Drake Boulevard on-ramp. The East Sir Francis Drake Boulevard off-ramp also serves traffic from northbound US 101 destined for I-580 and the Richmond/San Rafael Bridge. These conflicts result in additional traffic delays and create increased traffic demand at the northbound US 101 off-ramp intersection at East Sir Francis Drake Boulevard. This concern was repeatedly voiced by the public at various community meetings and project stakeholder meetings.

4.3 Future No-Build Traffic Operations Deficiencies (Year 2035)

Traffic volumes are forecasted to increase by approximately 40% overall by Year 2035, according to the future analysis scenario. Tables 4.2 and 4.3 below compare the existing traffic volumes with the future traffic volumes along the corridor.

Table 4.2 AM Peak Hour Mainline Segment and Ramp Volumes

Northbound US 101			
Freeway Segment / Ramp	**Existing**	**Year 2035**	
		No-Build	**Project**
Mainlines			
Between Southern Edge of Study Area and Tamalpais Drive	5,311	7,730	7,730
Between Tamalpais Drive and Industrial Way / Wornum Drive	5,363	7,440	7,440
Sir Francis Drake Interchange (across Corte Madera Creek)	3,362	4,840	5,150
Between Sir Francis Drake and I-580 Off-Ramp	4,180	5,900	5,900
Ramps			
Tamalpais Off-Ramp	915	1,560	1,540
Tamalpais On-Ramp	966	1,270	1,260
Industrial / Wornum Off-Ramp	255	260	400
Wornum On-Ramp	N/A	N/A	560
Sir Francis Drake Off-Ramp	2,279	3,320	3,010
Sir Francis Drake On-Ramp	818	1,060	750
Southbound US 101			
Freeway Segment / Ramp	**Existing**	**Year 2035**	
		No-Build	**Project[1]**
Mainlines			
Anderson Drive On-Ramp and Sir Francis Drake	5,704	8,940	8,940
Sir Francis Drake Interchange (across Corte Madera Creek)	4,493	7,240	7,240
Between Fifer and Madera	6,556	9,070	8,460
Between Madera and Tamalpais[1]	6,555	8,810	N/A
Between Tamalpais and Southern Edge of Study Area	6,292	8,400	8,400
Ramps			
Sir Francis Drake Off-Ramp	1,211	1,700	1,700
Sir Francis Drake On-Ramp	2,335	2,780	2,780
Fifer On-Ramp	287	290	N/A
Wornum Off-Ramp	N/A	N/A	1,110
Madera Off-Ramp[1]	234	530	N/A
Madera On-Ramp[1]	233	270	N/A
Tamalpais Off-Ramp	979	1,440	1,310
Tamalpais On-Ramp	718	1,030	1,240

Notes:

1. Southbound improvements were modeled with the ultimate improvements, which included removing the Madera ramps and reconstructing the Tamalpais Drive interchange.

Source: Fehr & Peers, 2007

Table 4.3 PM Peak Hour Mainline Segment and Ramp Volumes

Northbound US 101			
Freeway Segment / Ramp	**Existing**	**Year 2035**	
		No-Build	**Project**
Mainlines			
Between Edge of study area and Tamalpais	6,358	8,350	8,350
Between Tamalpais and Industrial / Wornum	6,068	7,930	8,040
Sir Francis Drake Interchange (across Corte Madera Creek)	4,069	5,690	5,980
Between Sir Francis Drake and I-580 Off-Ramp	5,459	7,200	7,200
Ramps			
Tamalpais Off-Ramp	1,291	1,840	1,680
Tamalpais On-Ramp	1,007	1,420	1,390
Industrial / Wornum Off-Ramp	88	100	260
Wornum On-Ramp	N/A	N/A	610
Sir Francis Drake Off-Ramp	2,965	3,750	3,460
Sir Francis Drake On-Ramp	1,390	1,520	1,220
Southbound US 101			
Freeway Segment / Ramp	**Existing**	**Year 2035**	
		No-Build	**Project[1]**
Mainlines			
Anderson Drive On-Ramp and Sir Francis Drake	4,452	6,850	6,850
Sir Francis Drake Interchange (across Corte Madera Creek)	3,651	5,880	5,880
Between Wornum and Madera	5,429	7,960	7,490
Between Madera and Tamalpais[1]	5,333	7,690	N/A
Between Tamalpais and Edge of study area	5,052	7,370	7,370
Ramps			
Sir Francis Drake Off-Ramp	801	980	980
Sir Francis Drake On-Ramp	2,152	2,710	2,710
Fifer On-Ramp	222	230	N/A
Madera Off-Ramp[1]	234	500	N/A
Madera On-Ramp[1]	233	280	N/A
Wornum Off-Ramp	361	N/A	750
Tamalpais Off-Ramp	944	1,110	1,010
Tamalpais On-Ramp	666	800	890

Notes:

1. Southbound improvements were modeled with the ultimate improvements, which included removing the Madera ramps and reconstructing the Tamalpais Drive interchange.

Source: Fehr & Peers, 2007

The analysis of the future Year 2035 conditions accounts for the completion of the US 101 Gap Closure Projects. Even with the HOV lane improvements in place, a majority of the corridor would deteriorate to LOS F including:

- **AM peak hour**
  - Northbound US 101 would operate at LOS F from Tamalpais Drive to Industrial Way.
  - Southbound US 101 would operate at LOS F from Anderson Drive to Lucky Drive.
- **PM peak hour:**
  - Northbound US 101 would continue to operate at LOS F from Tamalpais Drive to I-580.
  - Southbound US 101 would operate at LOS F from Anderson Drive to Lucky Drive.

The analysis indicates that congestion and queuing will be present throughout this entire freeway section. The Year 2035 No-Build conditions are summarized below in Table 4.4.

Table 4.4 Year 2035 US 101 Freeway Segment Levels of Service

Freeway Segment	AM Peak Hour		PM Peak Hour	
	Density[1]	LOS	Density[1]	LOS
Northbound US 101				
Between Edge of study area and Tamalpais	--	--	115	F
Between Tamalpais and Industrial	--	--	80	F
Between Industrial Way and Sir Francis Drake [2]	--	--	N/A	N/A
Between Sir Francis Drake and I-580 off-ramp	--	--	35	D/E
Southbound US 101				
Between Anderson off-ramp and Sir Francis Drake	100	F	--	--
Sir Francis Drake Interchange	30	D	--	--
Between Sir Francis Drake and Fifer (weave)	50	F	--	--
Between Fifer and Madera (weave)	50	F	--	--
Between Madera and Tamalpais (weave)	35	D/E	--	--
Between Tamalpais and Edge of study area	25	D	--	--

Notes:
1. Density is expressed in vehicles per mile per lane and is based on the average of ten of twenty model runs with different random seed numbers.
2. No weaving is permitted between the Industrial Drive On-ramp and the Sir Francis Drake Off-ramp. Industrial Drive traffic must travel along the Sir Francis Drake Off-ramp and proceed through the ramp intersection before entering northbound US-101.

Source: Fehr & Peers, July 2009

4.4 Safety and Traffic Accident Data

Table 4.5 presents a summary of the accident information obtained from the Traffic Surveillance and Analysis System (TASAS) Table B report provided by Caltrans for the 3-year period between January 2007 and December 2009. It represents the freeway mainline and ramp accident rates on US 101 between Tamalpais Drive and Sir Francis Drake Boulevard.

The table illustrates that the total accident rate of 1.01 per million vehicle miles (MVM) for northbound US 101 is lower than the statewide average of 1.05 per MVM. In the southbound direction, the accident rate was reported to be 0.45 per MVM and is lower than the statewide average of 1.01 accidents per MVM for similar type of facilities.

Table 4.5 Study Area Collision Rate (2007-2009)

Location	No. of Collisions			Actual Collision Rate			Caltrans Average Collision Rate		
	Total	F	I	F	F+I	Total	F	F+I	Total
Mainline									
US-101 NB (PM 7.2/8.9)	157	0	46	0.000	0.30	1.01	0.011	0.32	1.05
US-101 SB (PM 7.2/8.9)	69	0	20	0.000	0.13	0.45	0.011	0.32	1.05
Ramps - Northbound									
Tamalpais Dr. off-ramp	10	0	5	0.000	0.30	0.61	0.004	0.42	1.20
Tamalpais Dr. on-ramp from EB Tamalpais Dr.	1	0	1	0.000	0.11	0.11	0.003	0.20	0.70
Tamalpais Dr. on-ramp from WB Tamalpais Dr.	1	0	1	0.000	0.14	0.14	0.003	0.20	0.65
Industrial Way off-ramp	6	0	1	0.000	**0.31**	**1.86**	0.004	0.28	0.95
Sir Francis Drake Boulevard off-ramp	6	0	3	0.000	0.09	0.17	0.002	0.09	0.30
Industrial Way on-ramp	0	0	0	0.000	0.00	0.00	0.002	0.16	0.55
Segment – NB 101 off to WB SFD	5	0	1	0.000	0.07	0.33	0.005	0.20	0.60
Segment – NB 101 off to EB SFD	5	0	1	0.000	0.05	.024	0.004	0.26	0.85
Sir Francis Drake Boulevard on-ramp	9	0	6	0.000	**0.31**	0.46	0.002	0.26	0.75

Ramps – Southbound									
Tamalpais Dr. on-ramp from EB Tamalpais Dr.	0	0	0	0.000	0.00	0.00	0.003	0.20	0.65
Tamalpais Dr. on-ramp from WB Tamalpais Dr.	0	0	0	0.000	0.00	0.00	0.004	0.20	0.70
Tamalpais Dr. off-ramp	9	0	6	0.000	**0.46**	0.69	0.004	0.42	1.20
Madera Boulevard on-ramp	1	0	0	0.000	0.00	0.19	0.002	0.16	0.55
Madera Boulevard off-ramp	4	0	1	0.000	0.14	0.57	0.004	0.28	0.95
Fifer Ave. on-ramp	1	0	1	0.000	**0.21**	0.21	0.002	0.16	0.55
Fifer Ave. off-ramp	1	0	0	0.000	0.00	0.12	0.002	0.18	0.60
Sir Francis Drake Boulevard on-ramp	5	0	0	0.000	0.00	0.18	0.002	0.06	0.20
Segment – SB 101 on from EB SFD	2	0	1	0.000	0.07	0.14	0.003	0.20	0.65
Segment – SB 101 on from WB SFD	2	0	0	0.000	0.00	0..15	0.004	0.15	0.45
Segment – SB 101 off to EB SFD	3	0	0	0.000	0.00	0.69	0.004	0.42	1.20
Segment – SB 101 off to WB SFD	0	0	0	0.000	0.00	0.00	0.002	0.26	0.85
Sir Francis Drake Boulevard off-ramp	2	0	0	0.000	0.00	0.13	0.002	0.09	0.30

Note: **Bold** indicates actual collision rate is greater than Caltrans average collision rate

Source: Caltrans 2011.

The mainline through the project area is below the statewide average for collision rate. The proposed project is not expected to negatively impact the accident rate. By removing existing weaving conflicts, it is expected that the project will create a safer condition.

In the northbound direction, the Industrial Way off-ramp will be removed with this proposed project. This will remove a location that is significantly higher in accident rate that the statewide average, 1.86/MVM vs. 0.95/MVM respectively.

The other ramps with higher than average accident rates are the NB Sir Francis Drake Blvd. on-ramp, the SB Tamalpais Dr. off-ramp, and the SB Fifer Ave on-ramp. These ramps do not appear to be excessive when compared to the statewide average for similar facilities. Specifically as follows:

- The northbound Sir Francis Drake on-ramp is higher for the F+I rate, but actually lower for the Total rate. The only improvements with this project at this location are a bus stop at the terminus. This is not expected to negatively impact the safety.

- The southbound Tamalpais Dr. off-ramp is higher for the F+I rate, but actually lower for the Total rate. The improvements in this location include an auxiliary lane that ends 400 feet south of the ramp, which is expected to reduce conflicts in the area.

- The southbound Fifer Ave. on-ramp is higher for the F+I rate, but actually lower for the Total rate. In fact, there was only one injury accident in the 3 year study period. In order to be below the statewide average that number would need to be zero. The proposed project relocates the Fifer Ave. direct connection from the mainline to a collector-distributor road and reduces conflicts within the area.

4.5 Ramp Metering

Discussions with project stakeholders and the impacted cities revealed that there are major traffic concerns relating to metering the on-ramps. There is one parallel street on each side of US 101 with very short distances between the on-ramps and local street intersections that severely constrains the ability to provide adequate ramp storage for metered ramps. However, ramp metering equipment is included in the project. HOV Bypass Lanes have been provided in the build alternative at the northbound Wornum Drive on-ramp and the southbound Sir Francis Drake Boulevard on-ramp.

Two project team meetings have been held to date to review the ramp metering exceptions of the build alternative. The meetings were held on September 22, 2010 and October 14, 2010. Participants included TAM, Caltrans and TAM consultants. The objective of the meetings was to coordinate with Caltrans, and to obtain their input on the preliminary design and the lack of the HOV Bypass Lanes at the Fifer Avenue and Madera Boulevard on-ramps. Caltrans Office of Traffic Systems was present for both meetings.

A Ramp Meter Exception Fact Sheet was approved for this project on March 4, 2011. An exception for HOV Bypass Lanes has been approved for the southbound Fifer Avenue connection to the Sir Francis Drake Boulevard on-ramp and for the southbound Madera Boulevard on-ramp.

To assess the impacts of ramp metering, the Traffic Operations Report prepared for the PA & ED phase for this project will include a discussion of on-ramp metering.

5. CORRIDOR AND SYSTEM COORDINATION

This project is consistent with planning efforts at all levels of government. Relevant planning efforts by different governmental organizations are discussed below.

The MTC's Transportation 2035, project reference number 21325, identified the need to improve the US 101/Greenbrae Interchange (the Sir Francisco Drake Boulevard interchange is also known as the Greenbrae Interchange). The current Greenbrae Corridor project includes improvements at this interchange and is consistent with the regional transportation plan.

The 25-Year Transportation Vision for Marin County identified the Greenbrae Interchange and the Tamalpais Drive Interchange as the highest priorities for future projects. The need for congestion relief on regional highways and local roads was also identified. This project is consistent with the focus of this document, which stresses the importance of a multi-modal future. Improvements and upgrades to existing pedestrian facilities and overcrossings as well as bus stops at appropriate locations are also included.

This project is also being coordinated with the proposed Central Marin Ferry Connection (CMFC) project, a separate project that will close the multi-modal facility gap between the north and south Greenway, and provide improved multi-modal access to the Larkspur Ferry Terminal and the future Sonoma Marin Area Rail Transit (SMART) Larkspur station.

Regional Measure 2 funds are programmed to make operations improvements in the Greenbrae Corridor. These improvements are also identified in the Marin County Transportation Authority Initial Project Report, which was prepared in cooperation with Caltrans, MTC and the local jurisdictions.

6. ALTERNATIVES DEVELOPMENT

Background of Alternative Development - Over twenty improvement concepts have been developed and considered by TAM during the past three years. These concepts were grouped as southbound US 101 improvements and as northbound US 101 improvements to facilitate engineering analysis and review by the various project stakeholders. The improvement concepts were further refined and screened down to four (4) southbound design options and four (4) northbound design options based on input from Caltrans, Marin County, the cities of Larkspur and San Rafael, the Town of Corte Madera, extensive stakeholder interviews, and a public workshop held on October 24, 2006.

Additional analysis was performed and the design alternatives were further developed and refined for presentation at the second public workshop which was held on March 27, 2007.

Following the second public workshop additional feasibility and traffic analysis were performed and additional stakeholder meetings were held. The improvement concepts were further refined and two (2) southbound and two (2) northbound options were selected for further evaluations. These options are known as Southbound Options A and C, and Northbound Options D and E. Elements of these alternatives include: freeway and street improvements to improve nonstandard geometric design

features such as weaving length and interchange spacing; improve traffic circulation for local access, ramp closures and potential traffic reroutes; potential right-of-way (ROW) impacts; impacts to existing structures; improvements to pedestrian and bicycle routes; and improved access to bus service. These alternatives were presented at the third public workshop on March 8, 2008.

At the workshop, stakeholders supported the concept of braided ramps over the other alternatives, and expressed their desire to maintain or improve access to local businesses. As a result of the public comments received, the TAM Board of Directors directed further screening of the alternatives and further discussions with the city councils and Caltrans.

Additional traffic analysis was performed and it revealed that while Southbound Option A is a viable option, in the Year 2035 the traffic on the Sir Francis Drake Boulevard on-ramp to southbound Hwy 101 would result in a longer travel time for motorists coming from areas west of the freeway and destined for southbound Hwy 101. As a result of the traffic findings, the stakeholders and the TAM Board dropped Southbound Option A from further consideration.

To address stakeholder concerns about removing the southbound Madera Boulevard hook ramps and the need to provide easy access to the Town Center, Southbound Option C was modified to include a frontage road system between Wornum and Tamalpais Boulevard, and reconstruction of the Tamalpais Interchange. A three phased approach was developed for the Southbound Option C and presented to Caltrans. However, due to funding limitations and opposition from the City of Corte Madera regarding the modifications to the Madera hook ramps, TAM decided to further refine the Southbound Option C and dropped improvement associated with the Tamalpais Interchange and the frontage road system.

It was further determined by TAM that either Northbound Option D or E could be paired with the southbound option to implement a complete transportation solution for the project. However, individual project stakeholders, the Town Of Corte Madera, the Cities of Larkspur, and the TAM Board all expressed their support of Northbound Option E and their opposition to Northbound Option D. The community has also expressed their support for Northbound Option E at numerous public open houses. On November 18, 2009 the City of Larkspur passed a resolution to send a letter to Caltrans making recommendations and outlining issues of concern regarding this project.

To fully examine Northbound Options D and E, TAM worked closely with Caltrans to study the two options. After a series of meetings and further analysis, TAM/Caltrans concluded that the Northbound Option E potentially had fewer adverse impacts to environmental resources, better interchange geometric features, and that it should be paired with the Southbound Option C to create the Build Alternative for the project. A detailed summary of the comparison of Northbound Options D and E is included as Attachment P.

In comparing the various aspects of Northbound Options D and E, the following additional findings were identified for Northbound Option D:

Environmental Considerations – Additional environmental impacts resulting uniquely from Northbound Option D, include:

- Permanent removal of potential special-status wildlife species habitat (900 sq ft of impacts to salt marsh vegetation which may provide habitat to California clapper rail, California black rail, and salt marsh harvest mouse);
- Permanent fill into a Water of the U.S. and impacts to potential special-status fish species habitat (3,200 sq ft of fill material to Corte Madera creek which may provide habitat to Central California Coast steelhead, Central California Coast Coho, Chinook, tidewater goby, and green sturgeon).
- Changes to the visual landscape of the project area by adding an additional bridge that would be 25 feet higher than the existing roadway structures and could impact views of San Francisco Bay and Mt. Tamalpais.

Design Features – Northbound Option D requires approval of six (6) Mandatory Design Exceptions, while Northbound Option E requires seven (7). However, it is expected that a Fact Sheet Exception to Mandatory Standards for Northbound Option D would be needed and would include an exception regarding the fact that Northbound Option D creates two partial interchanges.

Northbound Option D and Northbound Option E both require partial acquisitions from one (1) multi-family residential unit and eight (8) commercial properties. Northbound Option D could require the full acquisition of two commercial properties. Northbound Option D also requires approximately 10,000 square feet of additional new right of way as compared to Northbound Option E. The right of way cost for Northbound Option D is approximately $600,000 greater than for Northbound Option E.

Northbound Option D requires the removal and replacement of the existing bicycle and pedestrian path adjacent to the northbound Sir Francis Drake off-ramp which crosses Corte Madera Creek whereas Northbound Option E improves the safety for bicycle and pedestrian users by widening the existing bicycle path on the structure to a 12 feet wide multi-use path.

Traffic Operations – Both Northbound Options D and E improve the average vehicle speeds on US 101 over the No-Build scenario. The forecasted average vehicle speeds on northbound US 101 in the PM peak hour, between Tamalpais and Industrial/Wornum (approximately half mile), is slightly better with Northbound Option D, as the density is 40 as compared to a density of 45 for Northbound Option E. Both options improve the weaving conditions along US 101 and will operate at the same level of service during the PM Peak Period. The freeway ramp terminal intersections will operate at a slightly better LOS under northbound Option E.

Table 6.1 Mainline and Weaving Segment Analysis

MAINLINE AND WEAVING SEGMENT ANALYSIS

AM Peak Hour- Southbound US-101

Segment		No-Build		SB-C[2]	
		Density[1]	LOS	Density	LOS
Between Anderson on-ramp and Sir Francis Drake		**100**	**F**	**75**	**F**
Sir Francis Drake Interchange (across Corte Madera Creek)		30	D	25	D
Between Sir Francis Drake and Fifer	Mainline weave section	**50**	**F**	N/A	N/A
	Ramp weave section[3]	N/A	N/A	30	D
Between Fifer and Madera (weave) [4]		**50**	**F**	N/A	N/A
Between Madera and Tamalpais (weave) [4]		35	D/**E**	N/A	N/A
Between Tamalpais and Edge of study area		25	C/D	25	C

PM Peak Hour - Northbound US 101

Segment	No-Build		NB-D[5]		NB-E	
	Density[1]	LOS	Density	LOS	Density	LOS
Between Edge of study area and Tamalpais	**115**	**F**	30/**40**[6]	D/**E**[6]	30	D
Between Tamalpais and Industrial / Wornum	**80**	**F**	**40**[7]	**E**	**45**[8]	**E**
Between Industrial and Sir Francis Drake (ramp weave section)	N/A[9]	N/A[9]	20[10]	B/C	20[10]	B/C
Between Sir Francis Drake and I-580 Off-Ramp	35	D/**E**	25	C/D	25	C/D

Note: **Bold =** unacceptable LOS

1. Density is expressed in vehicles per mile per lane and is based on the average of ten of twenty model runs with different random seed numbers.
2. Option SB-C, Var D / NB-E traffic operations were not analyzed in VISSIM under the screening analysis. Unless noted, the results from Option SB-C, Var B / NB-E are displayed instead.
3. Sir Francis Drake Blvd. to Fifer Ave. weaving section runs parallel to US-101 under design option C. Under Option C, Fifer Ave. off-ramp from SB US-101 is removed.
4. Under project variation D, the Madera Boulevard ramps are removed.
5. Option SB-C, Var D / NB-E traffic operations were not analyzed in VISSIM under the screening analysis. Unless noted, the results from Option SB-C, Var B / NB-D are displayed instead.
6. With the reconstruction of the Tamalpais Drive interchange under southbound Variation D, traffic conditions to the south of Tamalpais Drive are expected to improve over Variation B. The range shown is between SB-C, Variation B and SB-A, Variation D as the segment density and LOS are expected to be in between these two 2 options.
7. Under NB-D, Tamalpais Drive to Industrial Way functions as a weave section.
8. Under NB-E, a weave section from Tamalpais Drive to Wornum Drive is created due to the project; vehicles with destinations to Industrial Way must exit at the Wornum Drive off-ramp.
9. No weaving is permitted between the Industrial Drive on-ramp and the Sir Francis Drake Blvd. off-ramp. Industrial Way traffic must travel along the Sir Francis Drake Blvd. off-ramp and proceed through the ramp intersection before entering northbound US-101.
10. Under design options D and E, Industrial Way to Sir Francis Drake Blvd. is separated from Northbound US 101 and runs parallel to the mainline as a collector-distributor road. Results are reported for weaving operations on the collector-distributor road and not the mainline.

Source: Fehr & Peers, April 2009

The level of service at the intersections along Tamal Vista and Redwood Highway are poorer under Northbound Option D as compared to Northbound Option E. The travel speeds along Tamal Vista Boulevard and Redwood Highway are also slightly lower under Northbound Option D as compared to Northbound Option E.

Cost of Alternative and Schedule – The tentative project schedule (Shown in Table 11.1) is based upon proceeding in the PA&ED Phase with Northbound Option E for the northbound improvements. Northbound Option D may have increased adverse impacts and may require additional mitigation, which could negatively impact the project cost and schedule. Anticipated studies associated with Northbound Option D could delay the project by another year resulting in more engineering costs.

Alternatives Screening – Northbound Option D has the potential for greater adverse impacts per the Alternatives Screening Memorandum (See Attachment E). Northbound Option E is preferred by the TAM Board as well as the City of Larkspur and Town of Corte Madera, and a majority of the attendees at the public workshops that were held for the project. Based on the collective data compiled as part of this report and input from Caltrans Staff, TAM and the community at large, Northbound Option E is more favorable than Northbound Option D.

Ultimate Project - In addition to the current proposed project, TAM intends to continue to pursue an eventual complete southbound solution (referred to as the Ultimate improvements). The Ultimate improvements, as shown in Attachment R, would continue to modify the existing ramps and interchanges within the project area, including the Tamalpais Drive interchange.

The **Ultimate Project** which is currently unfunded would remove the hook on- and off-ramps at Madera Avenue. A two-way parallel street would be constructed between Madera Avenue and Tamalpais Drive. The Tamalpais Drive overcrossing would be replaced with a wider structure and the southbound off and on-ramps at the Tamalpais Drive interchange would be reconstructed. The northbound off and on-ramps at Tamalpais Drive would also be widened.

The primary advantage of this design option is that it would completely eliminate short weaving sections through the entire project limit in both the southbound and northbound directions, from Sir Francis Drake Boulevard to Tamalpais Drive and still maintain important local access.

7. ALTERNATIVES

7.1 Alternative 1 – No-Build

The No-Build Alternative is the existing US 101 freeway and associated existing interchanges. It includes the recently completed US 101 Gap Closure Projects that closed the gap in the current HOV lane system between Lucky Drive in Corte Madera and North San Pedro Road in San Rafael.

7.2 Alternative 2 – Build Alternative (Combined Southbound Option C and Northbound Option E)

The Build Alternative consists of southbound and northbound improvements along US 101. The detailed improvements are described below.

7.2.1 Southbound Improvements

The southbound improvements for the Greenbrae Corridor Improvement Project consist of widening and realigning the existing southbound on-ramp from Sir Francis Drake Boulevard to merge onto southbound US 101 south of Fifer Avenue. The southbound Fifer Avenue on-ramp would merge with the southbound on-ramp from Sir Francis Drake Boulevard prior to merging onto southbound US 101. The existing southbound hook on and off-ramps to southbound US 101 at Fifer Avenue would be removed. The existing bus stop at the Lucky Drive/Fifer Avenue off-ramp would be replaced by two new bus stops: one at the Sir Francis Drake Boulevard off-ramp terminus and one on the west side of the realigned Fifer Avenue on-ramp to the collector-distributor road.

Improvements include the following:

- Widening the existing southbound US 101/Sir Francis Drake Boulevard off-ramp to two lanes.
- Widening the existing southbound US 101/Sir Francis Drake Boulevard on-ramp to two lanes as it crosses over Corte Madera Creek and extending the on-ramp as a collector-distributor road to Fifer Avenue before merging onto southbound US 101. The Fifer Avenue on-ramp will be relocated from the mainline to the new collector-distributor road. The new collector-distributor road will be separated from the freeway by a concrete barrier and will have ramp metering equipment installed.
- Constructing an auxiliary lane from the realigned Fifer Avenue/Sir Francis Drake Boulevard on-ramp, thru the Madera Boulevard hook ramps, to the Tamalpais Drive off-ramp, ending the auxiliary lane between the off-ramp and the loop on-ramp from westbound Tamalpais Drive.
- Optimizing the signal timing at the intersections along Tamal Vista and Madera Boulevards.
- Removing existing non-ADA compliant pedestrian overcrossing in the vicinity of Lucky Drive/Nellen Ave and adding pedestrian and bicycle facility improvements along Lucky Drive, Fifer Avenue, and Wornum Drive.
- Improving the existing transit stop at Fifer Avenue. Provide new regional transit stop at the Sir Francis Drake Boulevard off-ramp to connect with new local transit stops on Sir Francis Drake Boulevard.
- Constructing a new southbound off-ramp to Wornum Drive which would cross over the southbound on-ramp from Sir Francis Drake Boulevard.
- Constructing a new signalized intersection on Wornum Drive at the southbound off-ramp termini.

- Providing pedestrian and bicycle improvements along Tamal Vista Boulevard which include street widening, re-striping, signal optimization, and bike and pedestrian facility improvements.

7.2.2 Northbound Improvements

The northbound improvements consist of new northbound US 101 on and off-ramps at Wornum Drive using a diamond configuration. The existing northbound Sir Francis Drake Boulevard off-ramp would be realigned and the exit point would be relocated approximately 200 feet south of the existing Wornum Drive Undercrossing. Northbound traffic traveling to Sir Francis Drake Boulevard would exit US 101 just north of Wornum Drive, cross over the northbound Wornum Drive on-ramp, and continue north along a collector-distributor road to Industrial Way and Sir Francis Drake Boulevard. The existing northbound hook off-ramp at Industrial Way would be removed and the existing northbound hook on-ramp would be modified to merge into the new one-way collector-distributor road that extends to Sir Francis Drake Boulevard.

Improvements include the following:

- Constructing a northbound auxiliary lane from the existing northbound Tamalpais Drive on-ramp to the new northbound US 101 off-ramp to Wornum Drive.
- Constructing a new northbound on-ramp at Wornum Drive, which will go under a new structure constructed for the realigned northbound US 101 off-ramp to Sir Francis Drake Boulevard. Ramp metering equipment will be installed on the new Wornum Drive on-ramp
- Constructing a new signalized intersection on Wornum Drive at the northbound on and off-ramp termini.
- Realigning the existing northbound off-ramp to Sir Francis Drake Boulevard and relocating the freeway exit point to approximately 200 feet south of the existing Wornum Drive Undercrossing.
- Constructing a collector-distributor road beginning with the new Sir Francis Drake off-ramp exit point just south of Wornum Drive, which then crosses over the new northbound on-ramp at Wornum Drive and extends to the existing bridge crossing Corte Madera Creek to the Sir Francis Drake Boulevard off-ramps.
- Removing the existing northbound Industrial Way hook off-ramp.
- Realigning the existing northbound Industrial Way on-ramp to merge onto the new collector-distributor road, with no connection to the mainline, and constructing a new signalized intersection at Industrial Way and Redwood Highway.
- Realigning Redwood Highway from Wornum Drive to approximately 800 feet north of Rich Street and constructing sidewalks along the east side of Redwood Highway.
- Constructing bike lanes along Redwood Highway to allow for safe bicycle operations.

- Widening the existing multi-use path from Redwood Highway, along the existing off-ramp, to eastbound Sir Francis Drake Boulevard.
- Improving and optimizing the signal timing at the intersection of the northbound US 101 off-ramp at Sir Francis Drake Boulevard, the Redwood Highway and Industrial Way intersection, and the Redwood Highway and Wornum Drive intersection to address pedestrian and bicycle needs while providing optimal traffic operations.
- Relocating the existing transit stop from within the hook ramp system at Industrial Way to the proposed Wornum Drive off-ramp. Provide a new regional transit stop at the Sir Francis Drake Boulevard on-ramp to connect with new local transit stops on Sir Francis Drake Boulevard.
- Providing retaining walls and/or concrete barriers where there are grade differences between roadways, and where the standard separation width cannot be achieved due to right-of-way constraints.

This design eliminates the short weaving sections southbound between the Sir Francis Drake Boulevard on-ramp and Fifer Avenue off-ramp by braiding the US 101 on-ramp from Sir Francis Drake Boulevard with the new off-ramp to Wornum Drive and northbound between the existing Industrial Way on-ramp and the East Sir Francis Drake Boulevard off-ramp by braiding the US 101 off-ramp to Sir Francis Drake Boulevard with the new on-ramp from Wornum Drive.

Important local access to the freeway and crossing Corte Madera Creek is maintained with the build alternative. In the southbound direction, vehicles from Sir Francis Drake Boulevard can exit the collector-distributor road at Fifer Avenue. In the northbound direction, vehicles entering at Industrial Way will be able to cross over Corte Madera Creek to reach Sir Francis Drake Boulevard. This design concept provides a separation between vehicles entering and exiting the freeway and local traffic desiring to cross Corte Madera Creek.

The pavement design of the improvements examined both a 20 year design life and a 40 year design life for the pavement section. The Traffic Index (TI) used for the 20 year design life of the mainline was 11.5 with an Equivalent Single Axle Load (ESAL) of 6,086,848. The TI for the 40 year design life was 12.5 with an ESAL of 14,079,616. The pavement design for the ramps within the project were done using the highest TI and ESAL for the ramps. The TI used for the 20 year design life of the ramps was 10.5 with an ESAL of 2,770,860. The TI used for the 40 year design life of the ramps was 11.5 with an ESAL of 6,411,480. See the Pavement Strategy Checklist and the Life Cycle Cost Analysis (Attachment L) for the selection of the pavement sections.

7.3 Nonstandard Design Features

The proposed improvements in the build alternative would require approval of mandatory and advisory design exceptions for various design features.

Tables 7.1 and 7.2 summarize the design exceptions for each of the options based on the geometric exhibits prepared to date using available aerial topographic mapping.

Table 7.1 Nonstandard Design Features – Mandatory

	Mandatory Standard	Location	Design Exception
M1	504.2(2) Deceleration Length	Madera Boulevard southbound off-ramp	Standard Deceleration Length = 570' Deceleration Length Proposed = 270'
M2	201.1 Stopping Sight Distance	Sir Francis Drake Blvd southbound on-ramp (bridge over Wornum Drive)	Standard Stopping Sight Distance = 430 ft (50 mph) Stopping Sight Distance Proposed = 330 ft (43 mph)
M3	201.1 Stopping Sight Distance	At the existing US 101 Mainline over the Wornum Drive undercrossing,	Standard Stopping Sight Distance = 750 ft (70 mph) Stopping Sight Distance Proposed =334 ft (43 mph)
M4	202.2 Standards for Superelevation	Wornum Drive northbound off-ramp	Standard Superelevation Rate = 12% Proposed Superelevation Rate = 10%
M5	405.1 (2) (b) Corner Sight Distance	Wornum Drive northbound off-ramp, at signalized ramp intersection (WD3 Line)	Standard Sight Distance = 360 ft (45 mph) Sight Distance Proposed = 125 ft (20 mph)
M6	504.3 Location and Design of Ramp Intersections on the Crossroads	Wornum Drive, between northbound ramp intersection and Redwood Hwy intersection	Standard Intersection Spacing = 400 ft Intersection Spacing Proposed = 62 ft
M7	301.1 Traveled Way Width	Extension of existing 11 feet lanes on US 101 southbound, "M" Line, from Sta. 214+65 to 228+65 US 101 northbound from "M" Line Station 226+00 to 230+87	Standard Traveled Way Width = 12 ft Traveled Way Proposed = 11 ft
	302.1 Shoulder Width	In the median of Southbound 101 "M" Line, from Sta. 214+00 to 228+65 Northbound 101 "M" Line, from Sta. 214+00 to 228+65	Standard Shoulder Width = 10 ft Shoulder Width Proposed = 2 ft to 8 ft

	Mandatory Standard	Location	Design Exception
M8	201.1 Sight Distance	Sir Francis Drake Blvd southbound on-ramp, in the sag vertical curve, for PVI Sta. 214+57.81 (SFD1 Line)	Standard Headlight Stopping Sight Distance = 200 ft (30 mph) Headlight Stopping Sight Distance Proposed = 120 ft (20 mph) for a distance of 125 feet
M9	202.2 Standards for Superelevation	Sir Francis Drake Blvd. southbound on-ramp, curve R=950' (SFD1 Line)	Standard Superelevation Rate = 10% Superelevation Rate Proposed = 1.5%
M10	302.1 Shoulder Width	Sir Francis Drake Boulevard northbound off-ramp (SFDE3 Line)	Standard Right Shoulder Width = 8 ft Proposed Right Shoulder Width = 4 ft
M11	405.1 (2) (b) Corner Sight Distance	Sir Francis Drake Blvd. southbound off-ramp, at signalized ramp intersection (SFD5 Line)	Standard Sight Distance = 250 ft Sight Distance Proposed = 180 ft
M12	1003.1 (1) Bikeways Width	Sir Francis Drake Blvd. southbound on-ramp	Standard Bikeway Width = 8 ft Bikeway Width Proposed = 5 ft
M13	501.3 Interchange Spacing	Interchanges between Tamalpais Drive and Sir Francis Drake Boulevard	Standard Interchange Spacing = 1 mile Interchange Spacing Proposed = 0.5 mile to 0.65 mile

Working in consultation with Caltrans, additional geometric studies were performed to assess a future project to improve the freeway profile over the existing Wornum Drive Undercrossing. Due to a number of controlling factors, including the existing drainage pattern on US 101 to the north of Wornum Dr, it was determined that reconstructing US 101 in the future to provide a design speed of 70 mph would not be infeasible. However, the study found that the project will not preclude the ability to improve the freeway crest vertical curve to achieve a design speed of 55 mph in the future with minimal changes to the proposed project. The proposed structures at the northbound off-ramp to Sir Francis Drake Blvd and the southbound off-ramp to Wornum Drive, as well as the existing Wornum Drive undercrossing, will not need to be replaced with this future project. See Attachment Q for profiles of the proposed project as compared to the future project.

Table 7.2 Nonstandard Design Features – Advisory

	Advisory Standard	Location	Design Exception
A1	206.3(1) Through Lane Drops	US 101 Mainline at Tamalpais Drive off-ramp	Standard Length for Lane Drop = 780 ft (65mph) Length of Lane Drop Proposed = 585 ft (49mph)
A2	504.2(2) Standard Designs (Freeway Entrances & Exits) 504.7 Weaving Length	Madera Boulevard on-ramp Auxiliary Lane Between Madera Blvd on-ramp and Tamalpais Drive off-ramp	Standard Curve = 3000 ft for 167.11 ft Curve Proposed = 3000 ft for 142.0 ft Standard Weaving Length = 1600 ft Weaving Length Proposed = 585 ft
A3	504.7 Weaving Length	Auxiliary Lane Between Sir Francis Drake Blvd. on-ramp and Madera Blvd off-ramp	Standard Weaving Length = 1600 ft Weaving Length Provided = 1457 ft
A4	504.2(2) Standard Designs (Freeway Entrances & Exits)	Sir Francis Drake Boulevard on-ramp	Standard Curve Radius = 3000 ft Curve Radius Proposed = 8000 ft
A5	504.3(2)(b) Lane Drop Taper	Sir Francis Drake Boulevard on-ramp	Standard Lane Drop Taper = 30:1 Lane Drop Taper Proposed = 20:1
A6	504.2(2) Standard Designs (Freeway Entrances & Exits)	Wornum Drive southbound off-ramp	Standard Angle of Departure = 4º52'08" Angle of Departure Proposed = 2º26'20"
A7	404.3(2) Turning Templates	Industrial Way northbound on-ramp intersection	Standard Design Vehicle = STAA Truck Design Vehicle Used = BUS-40
A8	504.2(2) Standard Designs (Freeway Entrances)	Industrial Way northbound on-ramp	Ramp design does not conform to Figure 504.2A for length of 3000' curve and merge distances
A9	202.5 Superelevation Transition	Sir Francis Drake to SB 101 R=950' and R=4500'	Standard Transition Length = 150 ft Transition Length Proposed = 83.33 ft (6%/100 ft)

The Fact Sheet for Exception to Advisory Standards was approved by Caltrans on March 4, 2011. The Fact Sheet for Exception to Mandatory Standards was approved by Caltrans on March 14, 2011.

Supplemental Fact Sheets, if needed, will be prepared during the PA&ED Phase for any additional design exceptions identified during the PA&ED Phase.

7.4 Right of Way

The proposed improvements will have right-of-way impacts on existing commercial and residential parcels, in which partial acquisitions are required. The Build Alternative includes potential existing building demolition and access control changes. Table 7.3 summarizes the proposed right-of-way acquisitions as a result of the project:

Table 7.3 Summary of Right-of-way Acquisitions

Type of Parcels	Partial Take
Vacant Land	
SF Residential Units	
Multi-Family Residential Units	2
Commercial/ Industrial	15
Easements	
Others:	
Total	17

The estimated cost for right of way acquisition is approximately $9.6 Million. The estimated cost is based on current zoning and/or land use. Much of the right of way needed for the project is developed commercial or industrial property.

The Right of Way Data Sheet for the build alternative is included in Attachment M.

7.5 Utilities

Initial coordination with utility companies has been completed. Complete utility coordination and verification will be required during the PS&E Phase of the project. The need for positive location (potholing) as prescribed by Caltrans Policy will be determined once utility facilities have been plotted. Utility relocation is anticipated within the existing Caltrans right of way, including gas and electrical transmission lines. Minor utility adjustment and/or relocation such as sewer manholes, water valves, City street electrical and lighting, PG&E power poles and fire hydrants will be required on local streets.

7.6 Railroad

There is no work within the operating railroad right of way on this project.

7.7 Hazardous Material/Waste

An Initial Site Assessment (ISA) will be prepared during the PA&ED Phase of the project to address the potential for hazardous waste. Twenty-two hazardous material release sites have been identified within the minimum distances of the project area, seven of which are under active or pending regulatory oversight and could potentially affect development of the proposed project. Soils located near US 101 and access roads in the study area may contain elevated concentrations

of lead in exposed surface soils due to aerially deposited lead. This could pose a health hazard to construction workers and require the preparation of special soil management and disposal procedures during project development. The highest levels of lead, which could classify those soils as a hazardous waste, are generally found in soils within 30 feet of the edge of pavement. A Department of Toxic Substances Control (DTSC) Caltrans variance may be invoked to allow reuse of some lead affected soils within Caltrans rights-of-way. Buildings and existing bridge structures in the study area potentially contain asbestos, lead-based paint, and/or other common hazardous materials that must be abated prior to building and bridge demolition and renovation activities. A Preliminary Environmental Analysis Report (PEAR) has been prepared and is included as Attachment G.

7.8 Traffic Management Plan (TMP)

The proposed Build Alternative involves modifying existing freeway interchanges, adding or removing existing interchange ramps, and adding auxiliary lanes to the freeway mainline. It is anticipated that the proposed construction would require temporary roadway and shoulder closures and detouring.

A Transportation Management Plan (TMP) Data Sheet was completed to estimate the extent of traffic impacts and the associated costs. A TMP Data Sheet is included in Attachment H.

As a minimum, the TMP elements would include a Public Awareness Campaign, press releases to notify and inform motorists, business community groups, local entities, emergency services, and elected officials of upcoming closures or detours. Various TMP elements such as portable Changeable Message Signs, Caltrans Highway Information Network, and CHP Construction Zone Enhanced Enforcement Program (COZEEP) will be utilized to alleviate and minimize delay to the traveling public.

Lane closure charts and a detailed TMP for the project will be developed during the PS&E stage to minimize and prevent delay and inconvenience to the traveling public. The need for lane closures and specific TMP elements will be identified when the design is complete enough to determine the type of traffic impacts anticipated during construction, yet early enough to make design changes or additions required for traffic mitigation.

It is anticipated that the existing width and number of traffic lanes on the freeway will be maintained during construction for the majority of the construction period. Temporary concrete barriers will be used to separate traffic from work areas. To allow the continuous operation of existing roadway, staged construction is anticipated. At times, a temporary reduction of traffic lanes will be required to facilitate staging of traffic and construction work. Night time work outside peak hours is also expected. The need for necessary lane closures during off-peak hours or at night will be identified early in the design phase and will be documented in the lane closure charts.

The preliminary cost for various TMP elements, including COZEEP, is estimated to be $835,000. Further discussion with the Caltrans Office of Traffic Management will be done as the project progresses to obtain their review and input.

7.9 Bicycle, Pedestrian, and Transit Facilities

The proposed project is a multi-modal project and includes numerous bicycle and pedestrian improvements within the project limits. They include the following:

- Sidewalk and bicycle facility improvements along Lucky Drive and Nellen Avenue
- Sidewalk and bicycle facility improvements along Fifer Avenue between Nellen Avenue and Tamal Vista Boulevard
- Sidewalk and bicycle facility improvements along Redwood Highway between Wornum Drive and the northerly terminus of Redwood Highway
- Pedestrian and bicycle facility improvements along the ramps crossing Corte Madera Creek

The existing pedestrian walkways along the northbound Sir Francis Drake Boulevard off-ramp is less than 5 feet wide and do not meet current ADA requirements. Northbound improvements include widening to the existing walkway along the northbound Sir Francis Drake Boulevard off-ramp to a 12-foot wide facility.

Traffic signal timing improvements will be made at the following locations to address pedestrian and bicycle needs while providing optimal traffic operations for on-street traffic:

- Along Tamal Vista Boulevard and Madera Boulevards between Lucky Drive and Tamalpais Drive
- The proposed Wornum Drive on and off-ramp intersection, the northbound Hwy 101 off and on-ramps at Industrial Way, and the northbound Hwy 101 off-ramp at Sir Francis Drake Boulevard
- The Wornum Drive and Redwood Highway intersection

The project alternatives also include the following Class 1 and 2 bicycle improvements:

- New Class 2 Bikeways (Bike Lane) along Lucky Drive between the path on the southbound Sir Francis Drake Boulevard on-ramp and Nellen Avenue
- New Class 2 Bikeways (Bike Lane) along Tamal Vista Boulevard between Lucky Drive and Madera Boulevard
- New Class 2 Bikeways (Bike Lane) along Redwood Highway between Wornum Drive and the northern terminus of Redwood Highway
- New Class 1 Bikeway (Bike Path) from Nellen Avenue, to the run along the new Fifer Avenue connection; crossing Fifer Avenue and continuing next to the proposed southbound Wornum Drive off-ramp to Wornum Drive.

There are existing Golden Gate Transit commuter bus stops along US 101 at the following locations:

- Southbound 101 at Fifer Avenue
- Southbound 101 at Tamalpais Drive
- Northbound 101 at Tamalpais Drive
- Northbound 101 at Industrial Way

The existing Golden Gate Transit bus stops along US 101 will need to be relocated to accommodate the project improvements. Golden Gate Transit is requesting regional bus stops at the US 101/Sir Francis Drake Boulevard Interchange.

Marin Transit is requesting local bus stops on eastbound and westbound Sir Francis Drake Boulevard at the Greenbrae Interchange. These bus stops would allow passengers to transfer between local and regional buses as well as accessing the new SMART station just north of Sir Francis Drake Boulevard and the Larkspur Ferry Terminal.

TAM, Golden Gate Transit, and Marin Transit support the new bus stops at the US 101/Sir Francis Drake Boulevard Interchange. In the northbound direction, regional bus stops will be located at the terminus of the Wornum Drive off-ramp and at the on-ramp at Sir Francis Drake Boulevard. In the southbound direction, new bus stops located at both the end of the Sir Francis Drake Boulevard off-ramp and at the Fifer Avenue connection to the southbound Sir Francis Drake Boulevard on-ramp. The pairing of the regional bus stops and the connection between local and regional facilities is an important link for multi-modal travel within the project area

TAM is currently in the design stage of a parallel project known as the Central Marin Ferry Connection (CMFC) project. This project would improve the current pedestrian and bicycle connections along Sir Francis Drake Boulevard between the existing Larkspur Ferry Terminal and the new SMART station just north of Sir Francis Drake Boulevard. The project would ultimately provide a Class 1 bikeway or multi-use facility crossing over Corte Madera Creek, connecting to the existing Class 1 facility that starts at the intersection of Redwood Highway and Wornum Drive. These improvements would also connect to the pedestrian and bicycle improvements proposed for the Greenbrae Corridor project.

8. COMMUNITY INVOLVEMENT

TAM used Context Sensitive Solution (CSS) principles to integrate stakeholder input into the project development process. Public workshop sessions were held to inform the community about the project, and to interactively work with the community regarding potential improvement plans, and obtain feedback. Three public workshop sessions have been held to date, on October 24, 2006, on March 27, 2007, and on March 8, 2008.

Over 60 community members, elected officials, and other parties attended the first workshop held on October 24, 2006. Meeting participants had an opportunity to provide comments at the meeting, as

well as submit written comments at a later date. In terms of general vision and need for the project, many participants cited the need to prioritize projects and fast-track smaller components of a larger Greenbrae Corridor Improvement Project. Issues related to regional and local circulation as well as multi-modal improvements were identified as priorities. Some participants were concerned about bicycle and pedestrian safety and local access throughout the corridor. The majority of participants agreed that the overall operation and capacity of US 101, adjacent local streets, and interchanges in the area need to be improved. In terms of impacts to properties and business, many concerns were related to the impact caused by the removal of existing freeway ramps at Lucky Drive/Fifer Avenue and Madera Boulevard. Participants also expressed concern regarding a variety of environmental impacts, including noise, flooding, soil contamination, vibration from traffic, and encroachment into wetland areas. In relation to local and regional circulation, it was suggested that local traffic should remain separate from regional traffic on Highway 101. Interchange operations within the study limits were noted to be problematic, and improvements would be needed.

During the second public meeting held on March 27, 2007, preliminary improvement alternatives were presented to the public to gain their input. Some of these alternatives were later modified to, as presented in this PSR, Northbound Option D, Northbound Option E and Southbound Option C. Support was generally shown from the public for Southbound Option C and Northbound Option E, however, there were concerns regarding how additional traffic may result in increased delay along Sir Francis Drake Boulevard. Several participants expressed interest in maintaining existing on- and off-ramps at Madera Boulevard and Lucky Drive/Fifer Avenue. For the northbound improvements, the public generally supported the alternatives presented as they would provide better interchange spacing, and therefore would improve weaving related issues. Participants expressed concerns for the roundabout alternative at the proposed Wornum ramps, regarding the operations and safety, particularly for a two-lane roundabout.

Southbound Options A and C, and Northbound Options D and E, were reviewed with Caltrans and engineering staff from Larkspur and Corte Madera prior to their presentation at the third public workshop on March 8, 2008. Design variations, which included closing one or more of the Madera hook ramps and providing alternative access to Madera Boulevard and the Town Center, were also presented. Participants tended to support the concept of braided ramps over the other alternatives, and expressed some concern regarding their desire to maintain or improve access to the local area. The potential closure of the southbound Madera Boulevard ramps was still a concern. However, some felt that with an alternative access point such as the proposed parallel street access to Madera Blvd., closing the ramps would be acceptable. As a result of the public comments received, the TAM Board of Directors directed further screening of the alternatives and further discussions with the city councils and Caltrans.

Following the March 8, 2008 public workshop TAM staff informed Caltrans, Larkspur, and Corte Madera that their final input on the project alternatives would be needed for presentation at the TAM Board meeting scheduled for October 23, 2008, as TAM staff would be making a recommendation to the TAM Board on which alternatives to formally advance into the PA&ED Phase of the project. TAM staff and the project team met with Caltrans on May 23, August 20 and 28, 2008 to further

discuss the alternatives and to determine what alternatives would be recommended to the TAM Board.

At the October 23, 2008 TAM Board Meeting the TAM Board supported the CSS process and recommended that only Southbound Option C and Northbound Option E be carried into the PA&ED Phase.

TAM staff met with Caltrans on November 13, 2008, November 20, 2008, and December 9, 2008 to initiate the environmental studies and to explain to Caltrans the preference of the TAM Board to carry forward only Southbound Option C and Northbound Option E into the PA&ED Phase.

On March 24, 2009, TAM, in cooperation with Caltrans, hosted an informational open house at Redwood High School in Larkspur to present options under consideration for inclusion in the PA&ED study phase of the project. Approximately 75 members of the community and other interested parties attended the open house. The initial open house period was followed by brief remarks by TAM staff, which included an update on the project's progress and the initiation of formal environmental studies. After the remarks, the open house resumed so that participants could continue to review exhibit boards and talk further with TAM representatives and project team members.

At this workshop, participants reviewed options currently under consideration to address congestion and improve safety in the corridor and adjacent streets. Participants had an opportunity to submit written comments at the meeting if they had input they wished to provide. At the open house, 24 comment sheets were submitted. An Open House Summary report was prepared to document the issues heard by project team members and the written comments submitted at the open house.

The TAM Board, and the Cities of Larkspur and Corte Madera have expressed their support for the project. Other than the public comments received during the public meetings noting concern regarding various elements of the proposed project, there is no known opposition to the project.

9. ENVIRONMENTAL DETERMINATION/DOCUMENTATION

It is anticipated that a Complex Environmental Assessment/Initial Study (EA/IS) would be the appropriate environmental document for the proposed project. Caltrans will be the lead agency for both NEPA and CEQA. Refer to Attachment G *Preliminary Environmental Analysis Report* for preliminary environmental analysis of the Build Alternative. A summary of the PEAR is below:

9.1 Land Use:

The proposed project study area is located within Marin County and includes portions of the City of Larkspur, Town of Corte Madera and unincorporated area of Greenbrae. Land uses include commercial and residential uses, as well as preserved wetlands and marshlands. The proposed project is consistent with state, regional and local plans. A discussion of land use will be included in the Community Impact Assessment.

The proposed project will increase the accessibility and connectivity of multiuse paths. These paths may be considered 4(f) resources, as may be the Shorebird Marsh and Corte Madera Ecological Preserve. Construction on or near the multiuse paths could cause result in a "temporary occupancy" of Section 4(f) resources. A Section 4(f) Evaluation is recommended.

9.2 Growth:

The proposed project is in an urbanized and geographically constrained corridor. In addition, the affected municipalities have policies regarding growth, and its management, in their General Plans. The proposed project is supportive of planned growth, but unlikely to induce growth. A growth discussion will be included in the Community Impact Assessment.

9.3 Farmlands/Timberlands:

There are no prime or unique farmlands located in the project area, therefore no impacts.

9.4 Community Impacts:

The proposed project will remove the existing pedestrian overcrossing and shift pedestrian and bicycle traffic to the improved undercrossing at Wornum Drive, thus altering travel patterns for these users. The overcrossing will not be replaced to prevent a right of way acquisition. Refer to the PEAR (Attachment G) for more information.

Nellen Avenue, north of its intersection with Fifer Avenue, would become a cul-de-sac. This would result in approximately 0.09 mile of out of direction travel for the motorists accessing homes or businesses in this area from southbound US 101.

The project will require right-of-way, but no relocations. Right-of-way impacts will include loss of parking along Redwood Highway, but this parking will be replaced, and loss of vegetation. Due to these impacts, a Community Impact Assessment is recommended. See schedule for estimated timeline to complete these studies.

9.5 Visual/Aesthetics:

The project extends through relatively flat terrain and has views of natural resource areas, the San Francisco Bay, Corte Madera Creek, and Mt. Tamalpais. Within the study area, US 101 is not a designated state scenic highway.

Preparation of detailed photo simulations and a Visual Impact Assessment will be required during the PA/ED phase to document the potential changes to the visual environment and ability to direct lighting sources to avoid light and glare impacts. Native trees and vegetated areas disturbed by construction would be replaced and re-seeded. Tree and vegetation replacement costs are outlined in the *Anticipated Environmental Commitments Table* in Section 5.

See schedule for estimated timeline to complete these studies.

9.6 Cultural Resources:

A records search indicated six archaeological sites, none of which fall within US 101 ROW. Native American consultation did not identify any traditional cultural properties or Native American sacred sites. Since much of the records search area has been previously surveyed and is now an urban setting, additional surface survey is unlikely to provide substantive results.

There is the potential for buried archaeological sites within the project areas. These areas warrant subsurface testing prior to construction.

It is recommended a *Historic Property Survey Report*, *Historic Resource Evaluation Report*, and an *Archaeological Survey Report* is prepared. See schedule for estimated timeline to complete these studies.

9.7 Hydrology and Floodplain:

The proposed project is located within a mapped 100-year flood hazard zone and therefore encroachment would occur. As such, additional right-of-way may be required. In addition, lower lying areas of the project could experience increased flooding hazards in the event of sea level rise.

A Location Hydraulic Study is recommended. See schedule for estimated timeline to complete these studies.

9.8 Water Quality and Storm Water Runoff:

Stormwater in the project area is conveyed in earthen ditches, concrete-lined ditches, and culverts, ultimately discharging to Corte Madera Creek, bay-front marshlands and the San Francisco Bay. No runoff water quality features were observed during site reconnaissance.

The project will create additional impervious surface, thereby increasing the volume of stormwater runoff. NPDES permit coverage would be required.

A *Water Quality Report, Stormwater Data Report* (completed) and *Drainage Impact Summary Report* are recommended. See schedule for estimated timeline to complete these studies.

9.9 Geology, Soils, Seismic and Topography:

Topographic change in the project area is minimal, moving from sea level at Corte Madera Creek, to 23 feet above MSL at the US 101/Tamalpais Drive interchange. Geology and soils are dominated by artificial fill over marine and marsh deposits (Bay Mud) and a tectonic mixture of variably sheared shale and sandstone (Mélange). The potential for earthquakes may be considered moderate to high, and areas underlain by Bay Mud are prone to liquefaction.

In areas underlain by Bay Mud special consideration will be required for foundations, retaining walls and embankments.

9.10 Paleontology:

Based on the results of the core samples taken in and along Corte Madera Creek, the site of deepest excavation associated with the project, in support of the Central Marin Ferry Connection, paleontological resources are not anticipated to be impacted.

9.11 Hazardous Waste/Materials:

Twenty-two hazardous material release sites have been identified within the minimum distances of the project area, seven of which are under active or pending regulatory oversight. Soils located near US 101 and access roads may contain elevated concentrations of lead due to aerial depositions. Buildings and bridges potentially contain ACM, lead-based paint, and/or other common hazardous material that must be abated.

A Phase I Initial Site Assessment and a Phase II Environmental Site Assessment are recommended. See schedule for estimated timeline to complete these studies. The Phase II will be completed during the PS&E phase of the project.

9.12 Air Quality:

The region is non-attainment for ozone and the California PM_{10} standards and the region is designated for CO maintenance. The proposed project is not exempt from local conformity under 40 CFR 93.126 or regional conformity under 40 CFR 93.127. If a project is not exempt from conformity requirements, it must come from a conforming Regional Transportation Plan (RTP) and TIP. The most recent RTP in the project area is the *Transportation 2035 Plan*. The *Transportation 2035 Plan*, which was an update to the prior 2030 plan, was adopted by MTC in April 2009. The proposed project is included in the *Transportation 2035 Plan* and the 2009 TIP (MRN050001). The proposed project would improve the flow of traffic and reduce traffic congestion; however, it would redistribute vehicle trips.

An Air Quality Technical Report is recommended. The Air Quality Technical Study Report should include a quantitative CO hot-spot analysis, a qualitative analysis of particulate matter and diesel exhaust, a project-level conformity, and analysis of Mobile Source Air Toxics. See schedule for estimated timeline to complete this study.

9.13 Noise and Vibration:

The proposed project is a Type I project under the definitions provided in 23 CFR 772.5 because it would alter the vertical and horizontal alignment of an existing highway. Sensitive receptors in the Project area include a recreational area, hotels, and residential areas, including two mobile home parks. The Project area is already affected by existing traffic noise from US 101. Future noise levels in the Project area could increase due to increased traffic and roadway modifications. Further analysis is required to determine increases in noise levels that would be caused by the proposed Project. Noise modeling will be conducted for all sensitive receptors in the Project vicinity using Federal Highway Administration (FHWA) Traffic Noise Model Version 2.5. Modeling results will be used to determine if Project noise levels would exceed FHWA noise acceptability criteria (NAC) and/or if Project noise levels would exceed the CEQA significance thresholds for noise.

Acoustic feasibility and reasonableness from a cost perspective will also be evaluated for the Project. A Noise Study Report (NSR) will be prepared to evaluate Project-specific noise impacts and potential abatement measures, centering on the evaluation of noise barriers.

Construction cost estimates would not be provided in the NSR, but would be presented in the Noise Abatement Decision Report (NADR). Construction cost estimates are compared to reasonableness allowances in the NADR to identify which wall configurations are reasonable from a cost perspective.

Therefore, a NSR is recommended for the project including identification of any significant noise impacts. See schedule for estimated timeline to complete this study.

9.14 Energy and Climate Change:

Although the project is not considered a 'major project', energy analysis will include a memo to file. Per BAAQMD guidelines, the project would not require quantitative analysis for operational

emissions, but a quantitative analysis for $C0_2$ associated with construction is included. Qualitative analysis related to sea level rise will be included in the memo. See schedule for estimated timeline to complete this study.

9.15 Biological Environment:

The project may affect sensitive state- and federally-listed biological resources associated with Corte Madera Creek and its surrounding salt marsh habitat, due to widening of the existing bridges. Special-status wildlife species that may be affected include the following: tidewater goby (*Eucyclogobius newberryi*, FE), green sturgeon (*Acipenser medirostris*, FT), Central California Coast coho salmon (*Oncorhynchus kisutch*, FE/SE), Central California Coast steelhead (*Oncorhynchus mykiss*, FT), Chinook salmon (*Oncorhynchus tshawytscha*, FE), California black rail (*Laterallus jamaicensis coturniculus*, ST), California clapper rail (*Rallus longirostris obsoletus*, FE/SE), and salt marsh harvest mouse (*Reithrodontomys raviventris*, FE/SE).

The project is estimated to result in approximately 775 sq ft of direct and permanent impacts to salt marsh vegetation (i.e, potential California clapper rail and California black rail foraging habitat, and salt marsh harvest mouse habitat) due to placement of permanent bridge columns, along the southern shores of Corte Madera Creek west of US 101. The project is also estimated to result in approximately 62 square feet of impacts within Corte Madera Creek due to the placement of permanent structures within the ordinary high water mark, as well as approximately 11,500 square feet of additional shading due to the wider structure. Indirect impacts could include increased turbidity, noise and vibration during construction. Construction in and over Corte Madera Creek will be timed to correspond to agency work windows.

A Jurisdictional Delineation of Waters of the U.S. was completed in 2010 and surveys for sensitive species were completed in 2009.

Consultation with the US Fish and Wildlife Service and the National Marine Fisheries Service, resulting in a Biological Assessment/Biological Opinion will be required for all of the species mentioned above with the exception of the California black rail, which is not a federally-listed species. Consultation with the California Department of Game and Fish will also be required. Pre-construction surveys are required as suitable nesting habitat for migratory birds is available. Exclusionary bird netting will likely need to be installed prior to the onset of construction on overpasses and bridges in the project area to prevent nesting in these areas during construction.

A Natural Environment Study is recommended. See special considerations and project schedule for estimated timeline to complete biological resources tasks, agency coordination, and permits/agreement.

9.16 Cumulative Impacts:

The proposed project would be consistent with local planning goals and policies, and would not isolate communities or their focal points, require relocations or disproportionately impact environmental justice communities. Cumulative impacts resulting from visual impacts are not anticipated. Although the project is not anticipated to be growth inducing, it is supportive of planned growth. Due to potential increases in traffic, cumulative impacts related to air quality and traffic noise

are anticipated. However, air quality impacts may likely be offset in the future due to innovations in technology related to vehicles and fuel emissions. The proposed project, in light of reasonably foreseeable and future actions, would provide a net benefit to both local and regional communities and roadway users.

9.17 Context Sensitive Solutions:

The following are early planning activities and community involvement efforts that were undertaken during this initial phase of project development.

1. Stakeholder interviews, October 2006.
2. Public Workshop #1, October 24, 2006.
3. Public Workshop #2, March 27, 2007.
4. Public Workshop #3, March 8, 2008.
5. Informational Open House and Scoping Meeting, March 24, 2009.
6. Informational Open House and Scoping Meeting, September 29, 2009.
7. Periodic distribution of project newsletters to stakeholders within the study area.
8. Project updates on the TAM website, www.tam.ca.gov.

As a result of early planning activities and community involvement efforts, the following occurred in the scope of the project.

1. Inclusion of bicycle-pedestrian facilities as an integral part of the project.
2. Elimination of alternatives that would directly affect the ecological preserve.
3. Refinement of the build alternative to avoid or minimize loss of freeway fronting businesses.

10. FUNDING

This project is sponsored by the TAM, working in cooperation with Caltrans. The project is 100% funded by the Regional Measure 2 Program administered by MTC and Federal Funds. Preliminary construction cost estimates have been completed for the project and the cost summaries are shown in Table 10.1. Detailed preliminary cost estimates are included in Attachment J.

Table 10.1 Preliminary Project Cost Estimate Summary

	Build Alternative
Capital Cost	
Roadway Items	$73,959,000
Structure Items	$18,835,000
Subtotal Construction	**$92,795,000**
Right Of Way Items	$9,618,332
Total Capital Cost	**$102,413,332**
Project Development Costs	
PA&ED	$4,760,000
Design (PS&E)	$15,360,000
Construction Admin	$20,480,000
Right of Way Support	$685,000
Total Project Development Costs	**$41,285,000**
TOTAL PROJECT COST	**$143,700,000**

11. SCHEDULE

The tentative schedule for major project milestones as approved by TAM is shown in Table 11.1.

Table 11.1 Tentative Project Schedule

HQ Milestones	Delivery Date
PSR Approval	Winter 2011
PA & ED	Fall 2012
Final PS&E	Spring 2014
Right of Way Certification	Summer 2014
Ready To List (RTL)	Fall 2014
Complete Construction	Fall 2016

12. FHWA COORDINATION

The improvements involve work on US 101. Therefore coordination with Caltrans and FHWA is planned as part of the project development. TAM will work in partnership with Caltrans and FHWA to ensure that the project meets agency standards.

A Value Analysis Study was completed for this project in June 2010.

Federal-Aid funding for the project is anticipated.

13. COOPERATIVE AGREEMENT

An approved Cooperative Agreement (October 6, 2009) between the State of California (STATE) and the Transportation Authority of Marin (TAM) has been prepared for this project for the PA&ED and PS&E phases of the project. The Cooperative Agreement outlines the obligations and responsibilities of both the STATE and TAM. A copy of the Cooperative Agreement is included as Attachment L.

The State will be the Lead Agency for both NEPA and CEQA. TAM will be responsible for preparing the Environmental Document to meet the requirements of NEPA and CEQA. TAM is the implementing agency for PA&ED and PS&E phases. TAM will manage the public hearing process and provide technical resources as needed.

Under the current Cooperative Agreement TAM has agreed to fund 100% of the preliminary and design engineering costs for the Project. TAM has also agreed to prepare a Project Report (PR), and detailed plans, specifications, and estimates (PS&E) at no cost to the STATE.

Under the current Cooperative Agreement the STATE has agreed to provide project oversight, prompt reviews and approvals of submittals made by TAM; to provide quality assurance activities on all work done by TAM; and issue encroachment permits, all at no cost to TAM.

A separate Cooperative Agreement will be required to cover responsibilities and funding for the right of way acquisition and construction phase of the project. It is policy that the State advertise, award, and administer (AAA) all construction contracts on interstate routes. Presently, TAM is considering seeking an exception approval to the AAA policy.

14. FREEWAY AND MAINTENANCE AGREEMENTS

The existing Freeway and Maintenance Agreements between Caltrans and the cities will need to be modified. Additionally, an agreement between Caltrans and the local jurisdiction will be needed to secure the local's share of maintenance and operations costs of the new traffic signals at the intersection of Wornum Drive with the on- and off-ramps.

15. RISK ANALYSIS

A Risk Management Plan has been prepared for this project. The risk identifications and analysis will be completed and updated as appropriate through on-going Project Development Team meetings and team member's discussions and reviews. The current Risk Management Plan is included in Attachment M.

16. LOCAL ENTITY CONTACTS/DISTRICT CONTACT

Caltrans District 4

Caltrans Project Manager	Betcy Joseph	510-286-5097
Office Chief, Advance Planning	Patrick K Pang	510-286-5566
Branch Chief, Advance Planning	Warwick W.T. Cheung	510-622-0155
Advance Planning Transportation Engineer	Hugh Converse	510-286-6003
DOD District Coordinator	Michael Thomas	510-286-4687
DOD Design Reviewer	Larry Moore	510-286-4685
Branch Chief, Advance Planning, Forecasting	Phillip Cox	510-286-5584
Office Chief, Traffic Operations	Dave Seriani	510-286-4653

Transportation Authority of Marin

TAM Executive Director	Dianne Steinhauser	415-226-0820
TAM Project Manager	Bill Whitney	415-226-0823

Consultants

Jacobs Principle in Charge	Dina Potter	510-457-0027
Jacobs, Project Manager	Kai Chan	510-457-0027
Jacobs, Assistant Project Manager	Sean Mayer	510-457-0027
Jacobs, Environmental Manager	Lauren Abom	510-457-0027
Parisi Associates, Traffic Lead	David Parisi	415-388-8978
Fehr & Peers Associates, Traffic Engineer	Matt Haynes	415-348-0300
CirclePoint, Public Outreach Lead	Ben Strumwasser	415-227-1100

17. PROJECT REVIEWS

Field Review Kai Chan Date 10/15/10

District Maintenance Kim Le Date 12/15/10

District Safety Review Hung Q. Tran Date 1/13/11

Constructability Review Stewart Rucker Date 2/16/11

DES Review Tracy Bertram Date 10/7/09

HQ Design Coordinator Michael Thomas Date 3/4/11

Project Manager Betcy Joseph Date 3/4/11

ATTACHMENTS

A. Location Map

B. Vicinity Map

C. Traffic Forecast Data (Under Separate Cover)

D. Traffic Operations Analysis (March 14, 2011 Memorandum)

E. Alternatives Screening Memorandum (Under Separate Cover)

F. Geometric Concept Exhibits (Layouts, Profiles, and Typical Cross-sections)

G. Preliminary Environmental Analysis Report (PEAR) (Under Separate Cover)

H. Transportation Management Plan Data Sheet

I. Storm Water Data Report Signature Sheet

J. Preliminary Project Cost Estimates

K. Advanced Planning Study Memorandum

L. Pavement Strategy Checklist & Life Cycle Cost Analysis

M. Right-of-Way Data Sheet

N. Cooperative Agreement

O. Current Risk Management Plan

P. Comparison Between Northbound Option D and E

Q. Exhibits for Future Project (Mainline Design Speed of 55 mph)

R. Southbound Option C (Ultimate Project) Exhibit

ATTACHMENT A

LOCATION MAP

ATTACHMENT B

VICINITY MAP

ATTACHMENT C

TRAFFIC FORECAST DATA

(Under Separate Cover)

ATTACHMENT D

TRAFFIC OPERATIONS ANALYSIS

ATTACHMENT E

ALTERNATIVES SCREENING MEMORANDUM

(Under Separate Cover)

ATTACHMENT F

GEOMETRIC CONCEPT EXHIBITS

LAYOUTS, PROFILES, AND TYPICAL CROSS-SECTIONS

ATTACHMENT G

PRELIMINARY ENVIRONMENTAL ANALYSIS REPORT (PEAR)

(Under Separate Cover)

ATTACHMENT H

TRANSPORTATION MANAGEMENT PLAN DATA SHEET

ATTACHMENT I

STORM WATER DATA REPORT
SIGNATURE PAGE

ATTACHMENT J

PRELIMINARY PROJECT COST ESTIMATES

ATTACHMENT K

ADVANCED PLANNING STUDY MEMORANDUM

ATTACHMENT L

PAVEMENT STRATEGY CHECKLIST

&

LIFE CYCLE COST ANALYSIS

ATTACHMENT M

RIGHT-OF-WAY DATA SHEET

ATTACHMENT N

COOPERATIVE AGREEMENT

ATTACHMENT O

RISK MANAGEMENT PLAN

ATTACHMENT P

COMPARISON BETWEEN NORTHBOUND D & NORTHBOUND E

ATTACHMENT Q

EXHIBITS FOR FUTURE PROJECT

(MAINLINE DESIGN SPEED OF 55MPH)

ATTACHMENT R
SOUTHBOUND OPTION C
(ULTIMATE PROJECT) EXHIBIT


Add frontage roads to and from Madera Blvd.
Close Madera Blvd. ramps
Add on-ramp at Wornum Drive
Tamalpais Dr
Old Redwood Hwy
Nellen Ave
Sir Francis Drake Blvd
Extend auxiliary lane to Tamalpais Drive
Add frontage road to Madera Blvd.
Industrial Way
Reconstruct Tamalpais Interchange
N